9-16-3

REMARKS/ARGUMENTS

Favorable consideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-6 and 11 are pending in the application, with Claim 12 having been cancelled and Claims 1, 5, 6 and 11 having been amended by way of the present amendment.

In the outstanding Office Action, Claim 12 was rejected under 35 U.S.C. § 102(b) as being anticipated by Lee et al. (U.S. Patent No. 4,975,777, hereinafter Lee); Claims 1, 3-6 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee in view of Egawa et al. (U.S. Patent No. 5,572,256, hereinafter Egawa); Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee in view of Egawa and in further view of Watanabe et al. (U.S. Patent No. 5,512,950, hereinafter Watanabe).

Independent Claims 1, 6, and 11 have been amended to recite "an amplifying device configured to amplify a voltage signal corresponding to the electric charge limited by the charge-limiting device." Independent Claim 5 has been amended to recite "a third transistor configured to amplify a voltage signal corresponding to the electric charge limited by the second transistor." Support for these amendments is found in Applicants' originally filed specification.[1] No new matter is added.

Briefly recapitulating, amended Claim 1 is directed to an image pickup apparatus comprising an array of unit cells arranged in rows and columns. Each unit cell includes a light-receiving device configured to receive light and generate an electric charge corresponding to the light, a charge-accumulating section configured to accumulate the electric charge generated by the light-receiving device, a transfer device configured to transfer the electric charge from the light-receiving device to the charge-accumulating section, a charge-limiting device configured to limit the electric charge accumulated in the

[1] Specification, page 14, line 12; Figure 2.

charge-accumulating section, and an amplifying device configured to amplify a voltage signal corresponding to the electric charge limited by the charge-limiting device. The image pickup apparatus also comprises a plurality of vertical signal lines extending along the columns of unit cells, respectively. Each vertical line is configured to receive the amplified voltage signal amplified by the amplifying device of any unit cell of the associated column. The image pickup apparatus also comprises a control circuit configured to control each of the unit cells, to cause the charge-limiting device to limit the electric charge generated by the light-receiving device during a first period and subsequently transferred to the charge-accumulating section through the transfer device, to cause the charge-accumulating section to hold the electric charge limited by the charge-limiting device, and to add to the electric charge held in the charge-accumulating section an electric charge generated by the light-receiving device during a second period following the first period and subsequently transferred to the charge-accumulating section through the transfer device. Claims 5, 6, and 11 are directed to alternative embodiments of Applicants' invention. Applicants' inventions allow for increased dynamic range and simultaneous signal read out.[2]

Before describing Lee and Egawa in detail, Applicants note that both Lee and Egawa teach variants of a CCD type image pickup device, whereas Applicants' claimed invention is directed to a novel amplification type image pickup device. Both a CCD type image pickup device and an amplification type image pickup device read out electric data corresponding to an electric charge generated by a light-receiving device during a predetermined amount of time. However, a CCD type image pickup device and an amplification type image pickup device completely differ in their method of transmitting electric data. In a CCD type image pickup device, the electric charge generated by the light-receiving device is transferred to a vertical CCD via a transfer gate and then the electric charge is then transferred in a vertical

[2] Specification, page 4, lines 25-27.

direction by the vertical CCD. Since the CCD type image pickup device comprises a vertical CCD, it is possible to hold an electric charge during a predetermined period by the vertical CCD. It is also possible to transfer each of the electric charges generated by a plurality of light-receiving devices provided along a common column to the vertical CCD simultaneously during a common period. In contrast, in a conventional amplification type image pickup device, a voltage signal corresponding to the electric charge generated by the light-receiving device is amplified, and the *amplified* voltage signal is supplied to a vertical signal line. However, the vertical signal line in a conventional amplification type image pickup device does not hold the electric charge. A conventional amplification type image pickup device merely converts the electric charges generated by the light-receiving devices provided along the same column successively into voltage signals; successively amplifies the converted voltage signals by the amplifying devices; and successively supplies the amplified voltage signals to the vertical signal line. Therefore, in a conventional amplification type image pickup device, there is amplification but there is no holding of the electric charges generated by the light-receiving devices during a predetermined period. At least one patentably distinct improvement in the present application over the conventional amplification type image pickup device is the ability for an amplification type image pickup device to hold an electric charge during a predetermined period.

As noted previously, Lee nor Egawa teach variants of CCD devices. Specifically, Lee teaches transmission of electric data in the vertical direction by a CCD shift register 18 (vertical CCD).[3] Egawa teaches transmission of electric data in the vertical direction by an I-CCD (vertical CCD).[4] However, neither Lee nor Egawa teach or suggest "an amplifying device configured to amplify a voltage signal corresponding to the electric charge limited by the charge-limiting device." as recited in Applicants' amended Claims 1, 6, and 11. Also,

[3] Lee, Figures 1-2.
[4] Egawa, Figure 7A.

neither Lee nor Egawa teach or suggest the third transistor recited in Applicants' amended Claim 5. In addition, Egawa includes a process of adding an electric charge to the electric charge accumulated in the charge-accumulating section.[5] In this case, the vertical CCD (I-CCD) is used as a charge-accumulating section, thus addition is not realized by holding electric charges in the charge-accumulating section included in each of the unit cells as recited in Applicants' independent claims.

As none of the cited prior art, individually or in combination, disclose or suggest all the elements of independent Claims 1, 5, 6, and 11, Applicants submit the inventions defined by Claims 1, 5, 6, and 11, and all claims depending therefrom, are not rendered obvious by the asserted prior art for at least the reasons stated above.[6]

Accordingly, in view of the present amendment and in light of the previous discussion, Applicants respectfully submit that the present application is in condition for allowance and respectfully request an early and favorable action to that effect.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Eckhard H. Kuesters
Attorney of Record
Registration No. 28,870
Michael E. Monaco
Registration No. 52,041

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
EHK/MEM/kkn
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[5] Egawa, Figures 7B-7E.
[6] MPEP § 2142 "...the prior art reference (or references when combined) must teach or suggest **all** the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)."